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ABSTRACT

The Science in Action series is designed to teach practical science concepts to special-needs students. It is intended to develop students' problem-solving skills by teaching them to observe, record, analyze, conclude, and predict. This document contains a student workbook which deals with basic principles of life science. Six separate units include: (1) getting started; (2) the seedling; (3) roots; (4) stems; (5) leaves; and (6) new plants from old plants. The units consist of basic introductory information and questions, worksheets, a self-checking quiz, and instructions for experiments. A cumulative test is provided at the end of the workbook, along with a glossary. The teachers guide (which is included) explains how to use the workbook, together with teaching suggestions and enrichment activities for each unit. (TW)

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Green Plants

Life Science in Action

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Green Plants

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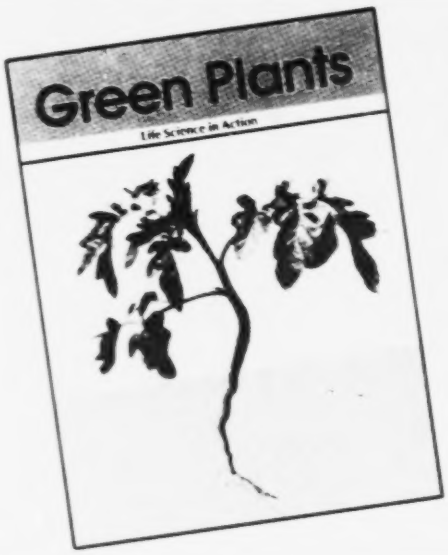

Teacher's Manual

Green Plants

Mary K. Friedland

A Janus **Life Science in Action** Book

Teacher's Manual written by Mary K. Friedland

OVERVIEW

Bringing Science Down to Earth

Why should poor readers miss out on science? We believe they shouldn't. So, we wrote ***Green Plants*** to appeal to older adolescents who have difficulty understanding words and concepts. And we designed it to actively involve those students in practical, relevant ways.

Part of the Janus ***Science in Action*** series, *Green Plants* is a workbook that introduces your special-needs students to the world of botany. We wrote *Green Plants* in language that's simple and direct. We designed activities that help students learn directly from their experiences. And we present science in terms that very low functioning students can understand.

Green Plants teaches students about gymnosperms, the green leafy plants. Students raise their own plants and discover what a plant needs to grow, how a plant develops, and why plants are important to people. *Green Plants* encourages students to find out more. It provides "graduated" activities that allow the neediest students to be successful, and the most capable to be challenged.

Built-In Success

Green Plants is designed to help the poor reader succeed. Each lesson is built around one major concept. Each concept is broken down into easy-to-handle steps. And reinforcement, review, and practical application are built into every lesson.

We designed this book to appeal to the older student. So, the tone of the book is mature. And the language, illustrations, and activities have been tailored to the interests of the older adolescent.

Green Plants is one of a set of ***Life Science in Action*** workbooks. It can be used as a text or as a laboratory workbook. It can be used in a science room, a resource room, or a self-contained classroom. *Green Plants* can help students meet general or laboratory science graduation requirements. Other Janus sets are ***Physical Science in Action*** and ***Earth Science in Action.***

OBJECTIVES OF THIS WORKBOOK

The Janus *Science in Action* series is designed to help special-needs students learn fundamental science concepts that can be applied to everyday living. It also helps them develop problem-solving skills by teaching them to observe, record, analyze, conclude, and predict.

The objectives of *Green Plants* are:

- To observe and record the growth of plants started from seeds.
- To learn what green plants need to stay alive and grow.
- To learn the function of roots, stems, and leaves.
- To start plants from cuttings.
- To learn a basic vocabulary for discussing plants and plant growth.

READABILITY

Green Plants is written below a 2.5 average reading level, according to the revised Spache Readability Formula. Difficult words in *Green Plants* appear in boldface type. Those words also appear in the glossary at the back of the book, and in the "Teaching the Units" section of this manual.

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We suggest that you build vocabulary exercises into daily lessons. When you start a unit, write vocabulary words on the chalkboard. Pronounce and define them. Have students look them up in the glossary. On succeeding days, start the lesson with a short review.

HOW TO USE THIS WORKBOOK

How the Units Are Organized

Green Plants is formatted to help the student know where to start, what to do, and when to stop. All units follow the same format.

Each unit begins with an introduction that prepares students for the learning to follow. Two or three topic questions tell students what they'll learn. "Before You Start" familiarizes them with new vocabulary.

A typical unit teaches two or three core concepts. A teaching page is followed by a reinforcing activity or experiment. Concepts are taught multi-modally so that each student can experience some success.

At the end of a unit, "Check Yourself" tests the student's understanding of core concepts. And "Check These Out" suggests enrichment projects at graduated levels of difficulty.

How to Introduce the Book

Bring some green plants into your room. Ask your students to identify the plants. Then ask what kinds of experiences students have had with plants. *(Where have you seen green plants? Have you ever taken care of plants? How have you seen plants change?)* Ask why green plants are important to us, and why it might be useful to know about green plants.

Then hand out the books. Let the students know that they will grow plants and do the activities illustrated in the book. Read the introduction out loud. Ask your class how they think plants are started.

How to Introduce the Unit

Write the unit's topic questions and vocabulary words on the chalkboard. Read the introduction and the questions on the board. Ask students what they know about those topics. Encourage them to relate their own experiences.

Then point to, pronounce, and define the vocabulary words. Have students do the "Before You Start" vocabulary exercise. Make sure all students understand these words.

Some General Suggestions

Keep the Class Together

We have found that many special-needs students don't succeed at science when they work alone. Those students need guidance, repetition, and reinforcement. Therefore, we suggest that you keep your students together as they work through this book.

Encourage interaction in class. Ask questions that generate discussion. Get students to talk about their activities and experiments. Partner students (e.g., a low-level one with a more capable one).

Green Plants is formatted so that students will recognize repeated activities. The first time an activity appears, walk students through it. Then, as that activity recurs, allow them more independence.

Supervise Experiments and Activities

We strongly recommend that you closely supervise activities and experiments. Have all materials ready; distribute them when the activity is about to begin. Demonstrate procedures that may be difficult or confusing. You may find it useful to set up a model of the activity in the science area.

Be Prepared!

Preparation and organization are critical. Here are some things we feel are absolutely essential:

- Read through an entire unit before you teach it. Collect all materials in advance.
- Try out all activities and experiments in advance. Pretend you are a student. You may want to adjust procedures or materials to fit your students' particular needs.
- Grow some plants in advance. Season and climate affect plant growth.
- Have extra plants on hand for students who don't have the plants they need.
- Research related topics. (The bibliography on page 6 of this manual suggests sources.) Keep reference books in the science area. Students will probably ask questions that are difficult to answer.
- Have supplementary books and activities on hand for students who work quickly. (Suggested research projects and enrichment activities appear under "Check These Out" in the workbook and "Teaching the Units" in this manual.)

The Mastery Test

The last unit of this book is a mastery test called "Show What You Learned." "What's the Answer?" tests core concepts, and "What's the Word?" tests target vocabulary.

The Glossary

The glossary at the back of the book defines all words that have been boldfaced in the text. Glossary entries are alphabetized and syllabified. Definitions include only what the student needs to know to understand the concepts in this book.

Encourage students to use the glossary to learn what words mean or how to spell them. By using the glossary, students learn introductory dictionary skills.

TEACHING THE UNITS

Unit 1: Getting Started

Target Words: *seedling, soil, sprout, transplant*

This unit tells the student how to plant seeds, and what seeds need in order to germinate.

PAGE 4: **Getting Started**

Students will use the glossary for "Before You Start." You may want your students to preview the glossary (page 47) before doing this exercise.

PAGE 5: **Getting Seeds to Grow**

Materials: *radish seeds, lima beans, containers for soaking seeds, water pitcher*

Students learn that germinating seeds need three things: soil, water, and warmth. Students are asked to soak the seeds they'll be planting. But first, students can examine the seeds and discuss what they think will happen during germination.

PAGES 6–7: **Experiment 1—How long do seeds take to sprout?**

Materials: *Styrofoam cups, potting soil, tomatoes, soaked bean and radish seeds, large spoons, pitcher of water*

Students plant radish, bean, and tomato seeds. They watch the seeds germinate, and learn that germination time differs for each kind of seed. (Radish is 1–4 days, bean is 3–7 days, and tomato is 5–9 days.)

Students will use these plants for experiments and activities throughout the book.

Some suggestions for the experiment:

- Tell the class that an *experiment* is a controlled activity that answers a question. Explain *materials, procedure, observations,* and *conclusions.*
- Germinate plenty of extra seeds.
- Plant seeds on a Friday, so seeds begin to sprout by Monday.
- Make sure seed cups have adequate drainage and are not overwatered (or seeds will rot).

PAGES 8–9: **Plant Watch**

Materials: *radish sprouts*

This activity, appearing at the end of each unit, asks the student to observe and draw plants.

This "Plant Watch" takes four days. Each day the student removes a germinating radish seed, describes it, and draws it. The notes and drawings are the student's record of how germination occurs.

PAGE 10: **Check Yourself**

1. 1. (Seedling) **b.** A very young plant **2.** (Soil) **a.** Earth that plants grow in **3.** (Sprout) **c.** Start to grow **2.** The seeds were soaked overnight. **3.** The seeds were planted in soil; the seeds were watered; the seeds were put in a warm place.

Enrichment Activities

- All students could transplant their seedlings. (See number 1 of "Check These Out.")
- Take the class to an outdoor area to look for seeds.
- Germinate some beans in a jar or in a small plastic bag so that students can watch what happens.

Unit 2: The Seedling

Target Words: *dissolve, fertilizer, fluorescent, leaves, light, nutrient, root, stem, water*

This unit describes the three main parts of a seedling (root, stem, leaves). It tells the student what a seedling needs in order to grow (water, light, and nutrients).

The unit introduction on page 11 refers students to the seeds they have just sprouted. Ask your students what they've done to get those seeds to grow.

PAGE 12: **Three Main Parts**

The three main parts of a plant are *root, stem,* and *leaves.* (Flowers are not discussed.) Each main part is involved in foodmaking.

Make sure your students thoroughly understand this lesson, since the rest of the unit is built on it.

PAGE 13: **Close-Up of a Seedling**

This exercise reviews three main parts. Students uproot a seedling and identify the main parts. Then they draw the seedling and label those parts. You may want to draw a large seedling on the chalkboard and have a student label *root, stem,* and *leaves.*

PAGE 14: **Plants Need Water**

Materials: *2 seedlings, scissors*

In this activity, students discover that plants contain water. The student finds water in a stem and in a leaf. Then the student removes the plant from the soil—its source of water—and lets it sit overnight.

This is a two-day activity. On the second day, the student observes that the uprooted seedling has become limp.

PAGE 15: **Plants Need Nutrients**

The students learn that plants need nutrients, which they get from soil. The students compare drawings of a fertilized and an unfertilized plant. (The fertilized one has many leaves and strong stems; the unfertilized one has few leaves and weak stems.)

In this lesson, nutrients are likened to vitamins. To introduce the lesson, ask students why people take vitamins. Suggest that plants have similar needs.

PAGE 16: **Plants Need Light**

This short lesson, preceding experiment 2, states that plant stems seek light. Ask students to notice that the classroom plants point toward light.

PAGES 16–17: **Experiment 2—What do plant stems grow toward?**

Materials: *tomato seedlings, empty tissue box, black paper, scissors, tape*

In this experiment, students discover that plant stems grow toward light. This is a four-day experiment. (It can be done over a weekend.)

The student puts seedlings in a box and covers most of the opening. After four days the student observes that the stems are tilted toward light.

Your students may want to know why stem tips grow toward light. For a good explanation, look up "auxin" in an encyclopedia.

PAGE 18: **Plant Watch**

The student is asked to draw a seedling from experiment 2. This should be done the same day the student finishes the experiment.

Help your students position the seedlings they want to draw. Show them how to hold the cup so that the stem is bent to the side.

PAGE 19: **Check Yourself**

Answers to puzzle: *Across* **4.** water **5.** root **6.** leaves **8.** nutrients *Down* **1.** dissolve **2.** light **3.** fertilizer **7.** stem

Enrichment Activities

- Celebrate Arbor Day. Plant trees in a public place.
- Take the class to a nature center. Find out what plants are indigenous to your area.
- Invite a speaker from the local agriculture office to visit your class.

Unit 3: Roots

Target Words: *absorb, main root, root hairs, secondary roots, stored*

This unit describes three kinds of roots (main root, secondary roots, root hairs) and explains the function of each.

PAGE 21: **The Hidden Part**

The student learns that roots perform three functions: They anchor the plant, store food, and absorb water and minerals. The student is asked what would happen to a plant whose roots stopped growing. (The stem and leaves would also stop growing.)

Tell your students what *rootbound* means. (Roots have no room to grow.) Show the class a rootbound plant. Ask why it's important to periodically transplant potted plants.

PAGE 22: **Water Finders**

Students learn how to identify three kinds of roots: The *main (tap) root* is the first to appear. *Secondary roots* grow horizontally from the tap root. *Root hairs* cover main and secondary roots.

Students learn how roots transport water: Root hairs absorb water; secondary roots carry water to the main root; the main root carries water to the stem.

If you'd like your students to see root hairs, sprout some beans. Root hairs should be visible on the large root. Let students look at that root under a microscope.

PAGE 23: **Get into a Root**

Materials: *carrot, knife, colored pencils*

The student identifies three parts of a carrot (a tap root) and draws a carrot showing each part.

We suggest that you cut the carrots in advance. The three parts show up clearly after the cut side has been exposed to air for an hour.

PAGE 24: **Plant Watch**

Students notice old and new parts on a bean plant. They discover that oldest parts are toward the center of the plant, and newest parts are at the tips.

At the end of this activity, ask students which parts of a plant grow. (The tips) To find out why tips grow, a student can research plant hormones.

PAGE 25: **Check Yourself**

1. a. Hold the plant in the ground; **c.** Store food; **d.** Get water and minerals **2.** The root hairs *absorb* water. Then water goes into the *secondary roots*. Next the water goes up the *main root* and into the *stem*.

Enrichment Activities

- Take the class to the grocery store. (See number 1 of "Check These Out.") Or, if students go on their own, first show them some roots to look for.
- Tell the class about medicinal uses of roots.

Unit 4: Stems

Target Words: *pipe, stalk, trunk*

This unit discusses the structure and function of a plant stem. The unit introduction (page 26) mentions three familiar stems: a celery stalk, a tree trunk, and a potato. After reading the introduction, ask your class about familiar stems—for example: *What stems have you eaten?* (asparagus, celery, potato, broccoli); *What stems do people build with?* (tree trunks, bamboo); *What stem is paper made from?* (tree trunk).

PAGE 27: **Up and Down the Pipes**

This lesson compares plant stems to plumbing pipes. In plant stems, some "pipes" move substances *up;* other "pipes" move substances *down*.

Tell your students that only substances *dissolved in water* can move through plant stems. They'll need that information for the next activity.

PAGES 28–29: **Inside a Stem**

Materials: *celery stalk with leaves, food coloring, knife, jar, colored pencils*

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Students find out how water moves in a celery stalk. This is a two-day activity.

On the first day, students put a celery stalk in colored water. We suggest that you demonstrate how to cut the stalk. And make sure the stalks are put in light—sap won't rise without it.

On the second day, students look for color on the stalk. (They should see colored dots on a cross-section, colored lines on a long piece, and colored veins in a leaf.) They draw the color on a diagram. They conclude that sap reached leaves by traveling through pipes in the stalk.

PAGE 30: **Plant Watch**

The students look at part of a bean plant stem. They should see leaves growing from small stems.

Some students may see small stems above the leaf stems. First flowers, then beans grow from those stems.

Students draw a plant and label the *main stem, a small stem, leaves,* and *anything growing from a small stem.* Students may want to discuss what they've drawn. Find out if anyone found flowers or beans.

PAGE 31: **Check Yourself**

Answers to puzzle: *Across* **3.** roots **5.** stalk **6.** stem *Down* **1.** pipes **2.** trunk **4.** leaves

Enrichment Activities

- Take your class "stalking." (See *Stalking the Wild Asparagus* in the bibliography.)
- Show students how to make potato prints: Cut a potato in half. Cut a design in the white part. Dip it in ink and press it on paper.
- Some students may want to color a flower. (See number 1 of "Check These Out.") Caution them to use very fresh flowers, and put them in good light.

Unit 5: Leaves

Target Words: *carbon dioxide, chlorophyll, energy, gases, oxygen, photosynthesis, water vapor*

This unit focuses on photosynthesis, making food out of water, air, light, and chlorophyll.

After the unit introduction (page 32), discuss "food." For example, ask: *Why do living things need food? Where does your food come from? Where can plants get food from?*

This unit contains several difficult science words. We suggest that each day you review the science words in that day's lesson.

PAGE 33: **Food Makers**

Students learn how plant leaves get water and air: Water enters roots and rises through stems; air enters leaves through stomata (holes).

Both plants and animals are nourished by food that leaves make. Students are asked what earth would be like if there were no green plants. Their responses can start a discussion on where food comes from. Point out that most food starts as water and air in a leaf.

PAGE 34: **In and Out**

Students learn that leaves take in carbon dioxide and give out oxygen.

Ask your class what gas people need. (Oxygen)

At the end of this lesson, students write that leaves take in *carbon dioxide* and give out *oxygen.* Ask your class where our oxygen comes from. (Green plants)

PAGE 35: **Experiment 3—What else do leaves give out?**

Materials: *a tomato plant, a plastic bag with a tie*

This is a two-day experiment. Students water a plant and tie a plastic bag over it. On the next day, they see water beads inside the bag and conclude that leaves give off water vapor.

The covered plant should be put in strong light.

PAGE 36: **What Goes Up Must Come Out**

Students trace the flow of water in a plant.

The students may wonder why water in plants moves against gravity. Here's why: Transpiration (water loss) alters a stem's concentration of sap. Water rises to restore equilibrium. More water is drawn from the soil to replace rising water.

PAGE 37: **The Facts of Light**

This lesson describes photosynthesis. Students define photosynthesis as *making things in light.*

PAGES 38–39: **Experiment 4—What does light do to chlorophyll?**

Materials: *beans, soaking containers, planting utensils, paper bags, pitcher of water*

This experiment takes about a week to complete. Students put beans in the dark to germinate. They get yellow sprouts. When they transfer the sprouts to the light, they turn green. Students conclude that light turns chlorophyll green.

PAGE 40: **Plant Watch**

The students observe that a plant's leaves spread out so that they all get light. The students draw that plant.

To introduce this activity, ask students what happens to leaves that don't get light. (They turn yellow or stop making food.) Show the class a large plant with leaves that are spread out.

PAGE 41: **Check Yourself**

1. water vapor **2.** light **3.** water **4.** chlorophyll **5.** green **6.** energy **7.** gases **8.** air

Enrichment Activities

- Take the class on a field trip to collect leaves. (See number 1 of "Check These Out.") Get books that will help students identify their leaves.
- Make planters for the seedlings from experiment 4. Consult a book on crafts for planter ideas.
- Make a big salad out of roots, stems, leaves, sprouts, and seeds. Ask each student to bring something.

Unit 6: New Plants from Old Plants

Students learn that plants can be started from cuttings. They start root cuttings, stem cuttings, and leaf cuttings. Then they try growing cuttings from several different plants and keep a record of which ones grow.

We suggest that you consult a book on growing plants from cuttings. (See the bibliography.)

PAGE 42: **Start Plants from Roots**

Materials: *carrot, knife, dish, other roots*

Students grow carrot cuttings in water. Then they try to grow other root cuttings. Give students roots that will grow and roots that won't. Sweet potatoes, beets, and parsnips grow well.

PAGE 43: **Start Plants from Stems**

Materials: *plants, potting supplies, soil*

Students put bean-stem cuttings in soil. Then they try to grow three other stem cuttings. Coleus stems, spider plant stems and pieces of potato (an underground stem) all grow well.

PAGE 44: **Start Plants from Leaves**

Materials: *leaves, potting supplies, soil*

Students put leaf cuttings in soil, then try to grow other plants from leaves. Jade, ivy, and philodendron work well. Try several houseplants.

PAGE 45: **Plant Watch**

Students draw a plant started from a cutting. Several days should elapse between planting and drawing.

Enrichment Activities

- Bring houseplants into your room. Have students research and chart how to take care of them. Rotate responsibility for the plants.
- Present a lesson on flowers and plant reproduction. Visit an arboretum or botanical garden.
- Discuss the effects of air pollution on plants, and plants on air pollution.

Show What You Learned

PAGE 46: **What's the Answer?**

1. a. Water; **b.** Warmth **2. a.** Leaves, root, and stem **3. a.** Hold a plant in the ground; **c.** Get water **4. c.** Through pipes **5. b.** Water, carbon dioxide, chlorophyll, and light energy

PAGE 46: **What's the Word?**

1. Seedling **2.** Dissolve **3.** Nutrients **4.** Absorb **5.** Stalk **6.** Photosynthesis **7.** Energy

TEACHING AIDS

Resources

- **USDA Agriculture Extension Office** There's at least one in every county.
- **Nurseries** and **florists**
- **Botanical gardens** and **nature centers**
- **Universities** that have agriculture departments
- **Mail order seed company catalog,** such as: W. Atlee Burpee (Box 748, Riverside, CA 92502); Farmer Seed and Nursery Co. (Fairbault, MN 55021); Gurney Seed and Nursery Co. (1448 Page Street, Yankton, SD 57078)
- **Encyclopedias** contain the most comprehensive information. *The World Book Encyclopedia, Compton's Encyclopedia,* and the *New Book of Popular Science* are written at about a 6.0 reading level.
- **USDA publications** are good sources for gardening information. Order pamphletsor a catalog through your congressman, the local USDA Agriculture Extension Office, or directly from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
- **Chevron Chemical Company** distributes excellent pamphlets on plant care and 4-H projects. Write to Public Relations, Chevron Chemical Co., P.O. Box 3744, San Francisco, CA 94119.
- **Sunset Books,** distributed through grocery, hardware, and plant stores, offer a variety of well-illustrated information on plant care.

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Introduction

Picture this:

You're moving into your own place. It's your first apartment! You've got a few chairs and a table. You've got a bed. You've got a stereo, and some other things.

You put all your things in the apartment. But even with all your things, the apartment looks a little empty. What else can you put in the apartment?

You don't have much money. But you want to get something that will make the place look great. What can you get?

You can get some green plants. You can buy them or you can start them yourself. But either way, you'll have to take care of those plants. What will you do to take care of them? How will you keep them green? How will you keep them growing? How will you keep them alive?

In this book, you'll learn about green plants. You'll learn how to start your own plants. You'll learn what plants need to grow and stay healthy. And you'll learn some scientific facts about plants.

You'll know a lot about green plants. So, when you move into your own place, you can use plants to make it look great.

Unit 1

Getting Started

Think of a plant. Is that plant green?

There are many different kinds of plants in this world. But most of the plants we see are green, like the plant you probably thought of.

You'll learn about green plants in this book. How? By watching plants grow.

Many green plants can be started from seeds. So that's how you'll begin—by starting plants from seeds.

- What makes seeds grow?
- How do seeds become plants?

You'll find out in this unit.

Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary that's at the back of this book. On the lines below, write what the words mean.

1. **seedling** _____

_____

2. **soil** _____

_____

3. **sprout** _____

_____

Getting Seeds to Grow

You'll be starting plants from three kinds of seeds: radish seeds, bean seeds, and tomato seeds.

The radish seeds will come from a packet of seeds. The bean seeds will come from the grocery store. And the tomato seeds will come right out of a tomato.

You'll do three things to get those seeds to grow. What do you think those three things are?

_____

_____

_____

Here are the three things you'll do:

1. You'll plant the seeds in soil.
2. You'll give the seeds water.
3. You'll put the planted seeds in a warm place.

Look around the room. Find a warm place where you can put the planted seeds. Where is that place?

_____

_____

You can get your bean seeds and radish seeds to sprout quickly. Here's how: Soak them in water for a while *before* you plant them in soil.

Soak the seeds right now. You'll need two cups and some water.

- Fill each cup half full with water.
- Put eight lima beans in one cup.
- Put eight radish seeds in the other cup.
- Let the seeds soak overnight.

Experiment 1
How long do seeds take to sprout?

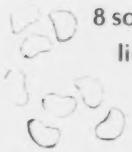
Some seeds take longer to sprout than others. For example, your radish, bean, and tomato seeds will sprout on different days. How many days will each take? Do this experiment and find out.

Materials (What you need)

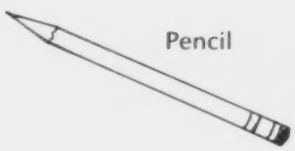
8 soaked radish seeds

8 tomato seeds

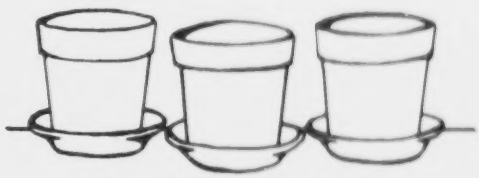
Soil



8 soaked lima beans



Pencil

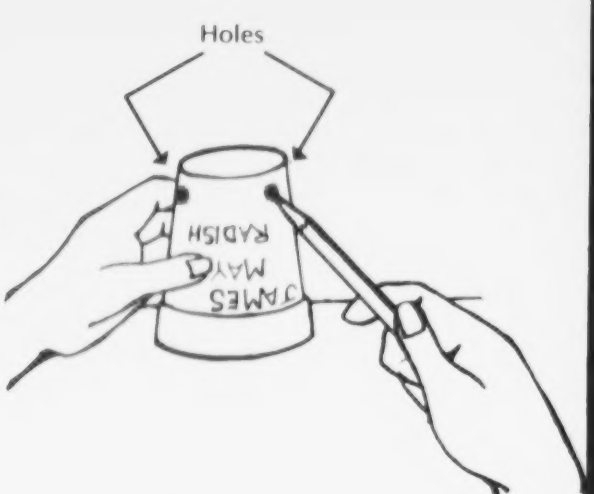


3 Styrofoam bowls on dishes

Procedure (What you do)

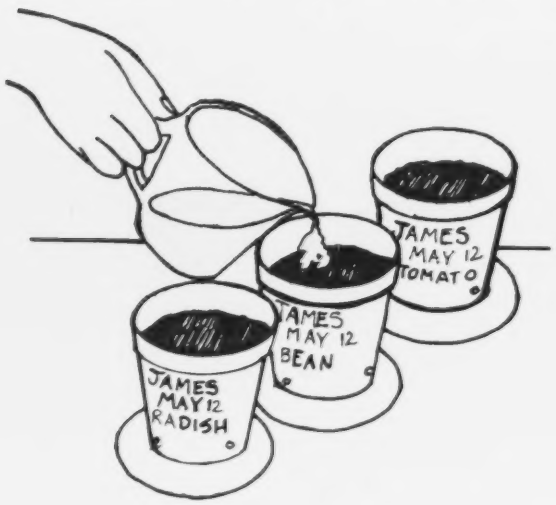
1. Write your name on each bowl. Then write today's date on each bowl. Next, write *radish* on the first bowl, *bean* on the second bowl, and *tomato* on the third bowl.

2. Turn the bowls upside down. With your pencil, poke three holes near the bottom of each bowl.



3. Fill each bowl almost to the top with soil. Put the seeds in the right bowls. Spread the seeds out. Cover them with a thin layer of soil.

4. Pour water on the top of the soil. Move the bowls to a warm place. Look at them every day. Under *Observations*, write the date when the first seedling comes up in each bowl.



Observations (What you see)

1. The first radish seedling came up on _____ (date).
2. The first bean seedling came up on _____ (date).
3. The first tomato seedling came up on _____ (date).

Conclusions (What you learn)

How many days did the seeds take to sprout?

1. The first radish seed took _____ days.
2. The first bean seed took _____ days.
3. The first tomato seed took _____ days.

Plant Watch

Watch your radish seeds grow into seedlings. See how they change.

Two days after you've planted the seeds, start watching them. Watch them every day for four days. On these pages, keep a record of what you see.

A Record of How Radish Seeds Grow

Two Days after Planting

Date: _____

Take a seed out of the soil. Look at it. What do you see growing out of the seed?

_____

_____

In the space at the right, draw what the seed looks like.

Three Days after Planting

Date: _____

Take another seed out of the soil. What's growing out of the seed?

_____

_____

Draw what the seed looks like.

Four Days after Planting

Date: _____

By now, you should have a seedling growing out of the soil. Carefully, take it out of the soil.

What does the seedling look like? Describe it.

_____

_____

Draw what the seedling looks like.

Five Days after Planting

Date: _____

Take another seedling out of the soil. Look at it.

Now look at the seedling you drew yesterday. How is today's seedling different?

_____

_____

Draw what the seedling looks like.

Check Yourself

1. What do the words at the left mean? Draw a line from each word to its meaning.

1. Seedling	a. Earth that plants grow in
2. Soil	b. A very young plant
3. Sprout	c. Start to grow

2. How did you get bean and radish seeds to sprout quickly?

   _____

3. What three things did you do to get your seeds to grow?

   _____

   _____

   _____

Check These Out

1. Find out how to **transplant** seedlings. Then transplant the seedlings that you have grown. Put each seedling in its own cup.
2. Take your radish seedlings home. Plant them in a large pot or in the ground. In three weeks, some radishes should be ready to eat.
3. Make a seed collection. Get seeds from fruits, vegetables, nuts, or outdoor plants. Tape the seeds on a large piece of heavy paper. Underneath each seed, write the name of the plant that the seed came from.
4. As you work through this book, you may want to find out more about plants. You can find out more by looking in an encyclopedia or by getting books about plants from a library. You can also talk to an expert, such as a gardener, florist, or botanist.

   Here are some things you may want to find out:

   - What's inside a seed? What does *germinate* mean?
   - Seeds often end up far away from the plants they came from. Seeds travel in many different ways. What are those ways?

Unit 2

The Seedling

You began to study plants by sprouting seeds. You put the seeds in soil. Soon, roots pushed out from the seeds. The roots grew quickly. Then, something green appeared on top of the soil. Your seeds had grown into seedlings.

- What are the three main parts of a seedling?
- What things make seedlings grow?

You'll find the answers in this unit.

Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **dissolve** _____

_____

2. **fertilizer** _____

_____

3. **nutrient** _____

_____

Three Main Parts

Look at a tomato seedling. And look at a bean seedling. They don't look exactly alike, but they're the same in this way: They both have three main parts.

What do you think the three parts are? (One part is below the soil.)

_____

_____

_____

The three parts are the **root**, the **stem**, and the **leaves**. All green plants have those three main parts.

A green plant is different from an animal in the way it gets its food. An animal can't make food. It eats plants or other animals. But a green plant makes its own food. All three parts—root, stem, and leaves—help the plant make its food.

To make its food, a plant needs lots of **water** and **light**.

Which part of the plant do you think gets water?

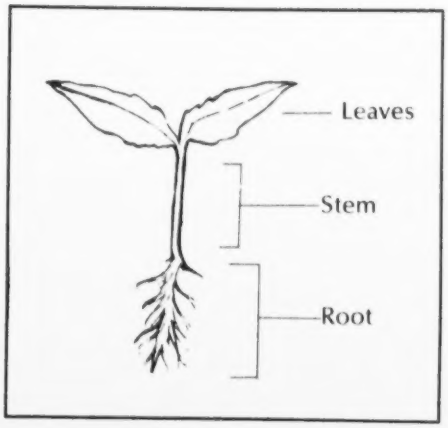
_____

Which two parts of the plant get light?

_____

_____

The root gets water for the plant. The stem and the leaves get light.



Tomato seedling

Close-Up of a Seedling

Choose a tomato seedling that you have grown. It should have at least two leaves. Carefully take the seedling out of the soil. Then brush the loose soil off the root.

Look for the three main parts. Do you see a root, a stem, and some leaves?

Draw the seedling in the space below. Write *root*, *stem*, and *leaves* next to those parts in your drawing. Your drawing will look something like the picture at the left.

Plants Need Water

When you planted your seeds, you watered them. Your seeds grew into seedlings, and you're still watering them.

What happens to the water you give your seedlings? Get a bean seedling and find out.

Cut off the stem close to the soil. Look at the stump—the part that's left in the soil. What is coming out of the stump?

_____

Hold the cut-off seedling straight up and down. Squeeze the bottom of the stem. What comes out?

_____

Crush a leaf between your fingers. What comes out?

_____

Something wet came out of the stump, the stem, and the leaves. That something is water. When you watered the soil, that water went into the seedling.

A plant, like your seedling, is made up mostly of water. Water helps the plant keep its shape. You can see this for yourself.

Carefully take a tomato seedling out of the soil. Lay it on a table for a day.

What do you think will happen to the seedling?

_____

_____

The next day, pick up the seedling. Look at it. What does the seedling look like?

_____

_____

A

B

Plants Need Nutrients

Imagine this: You're growing a healthy green plant. You give it enough water. But after a few months, some of its leaves fall off. The plant turns yellow. What's wrong?

This plant might need nutrients. Nutrients work like vitamins. They make plants strong and healthy. Plants that don't get nutrients grow weak and sickly.

Plants get nutrients from the soil. The nutrients are in the form of hard minerals. When you water the soil, the water dissolves the minerals. The dissolved minerals go into the plant with the water.

Plants can use up the nutrients in the soil. When that happens, more nutrients must be added. Dry fertilizer can be spread on the ground for outdoor plants. Liquid fertilizer can be put in the water that's given to houseplants.

The pictures on this page show two houseplants. These plants used up the nutrients that were in the soil. The plant in picture **A** gets fertilizer. The plant in picture **B** doesn't get fertilizer.

What does the plant in picture **A** look like?

_____

What does the plant in picture **B** look like?

_____

Which plant is healthier? The plant that gets fertilizer, or the plant that doesn't get fertilizer?

_____

_____

Plants Need Light

People say plants "like" the sun. You'll see what they mean if you look at a plant on a windowsill. The plant stem tilts toward the sun. Its leaves face the sun, as if to soak up the sunlight.

If you watch that plant for a day, you'll see that the stem tip moves. In the morning the tip points east, toward the sun. At noon, when the sun is straight above, the tip points straight up. During the afternoon, the tip follows the sun to the west.

The plant is seeking light. It needs light to make food.

If you watch the plant for several days, you'll see that it is growing. The stem gets longer, and new leaves come out. You'll also see that the plant is growing in a certain direction.

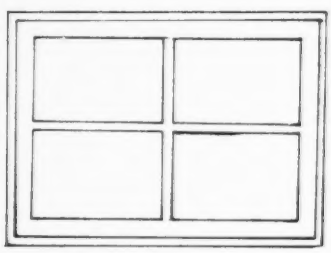
Stems of green plants grow toward one thing. What is that thing? Do this experiment and find out.

Experiment 2
What do plant stems grow toward?

Materials

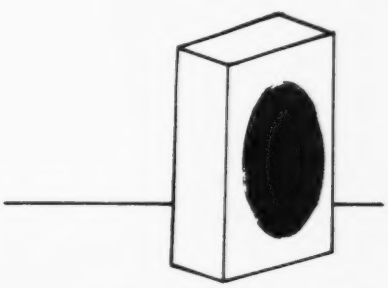
1 cup with two tomato seedlings in it

1 piece of black paper

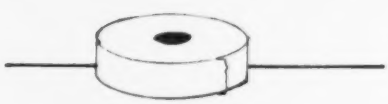


A sunny window

or



1 empty tissue box

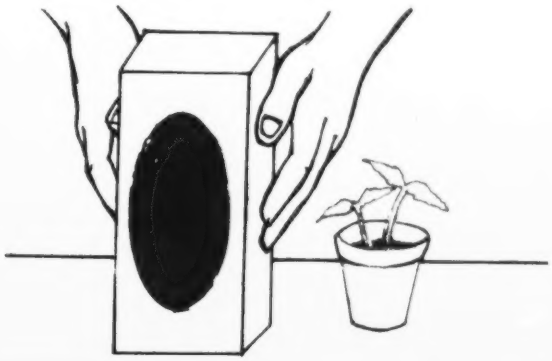


Tape

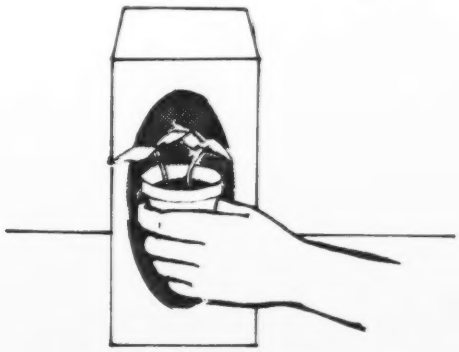
Strong fluorescent light

Procedure

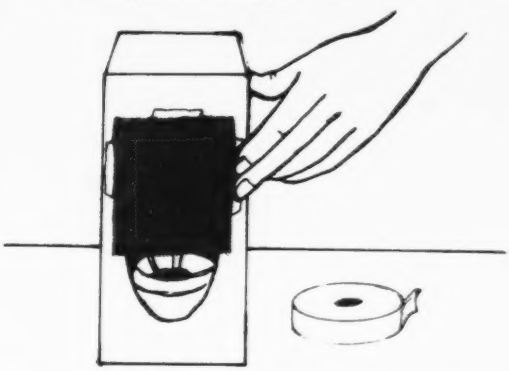
1. Stand the tissue box on its end.



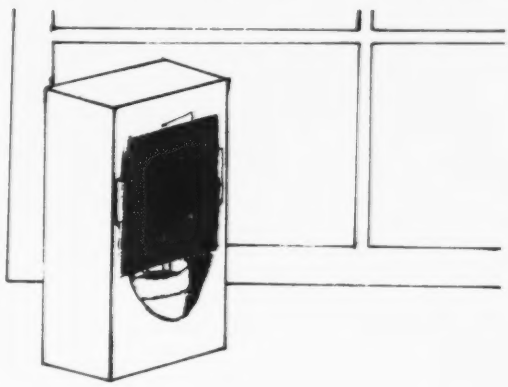
2. Put the seedlings inside the box.



3. Tape black paper over most of the opening on the box. But leave two inches at the bottom uncovered.



4. Put the box near a window or **fluorescent** light. Wait three days.



Observations

After three days, take the black paper off the tissue box. Look at the seedlings.

Which way are the stems pointed? Put an **X** in front of the right answer.

_____ Straight up

_____ Toward the opening of the box

_____ Toward the back of the box

Conclusion

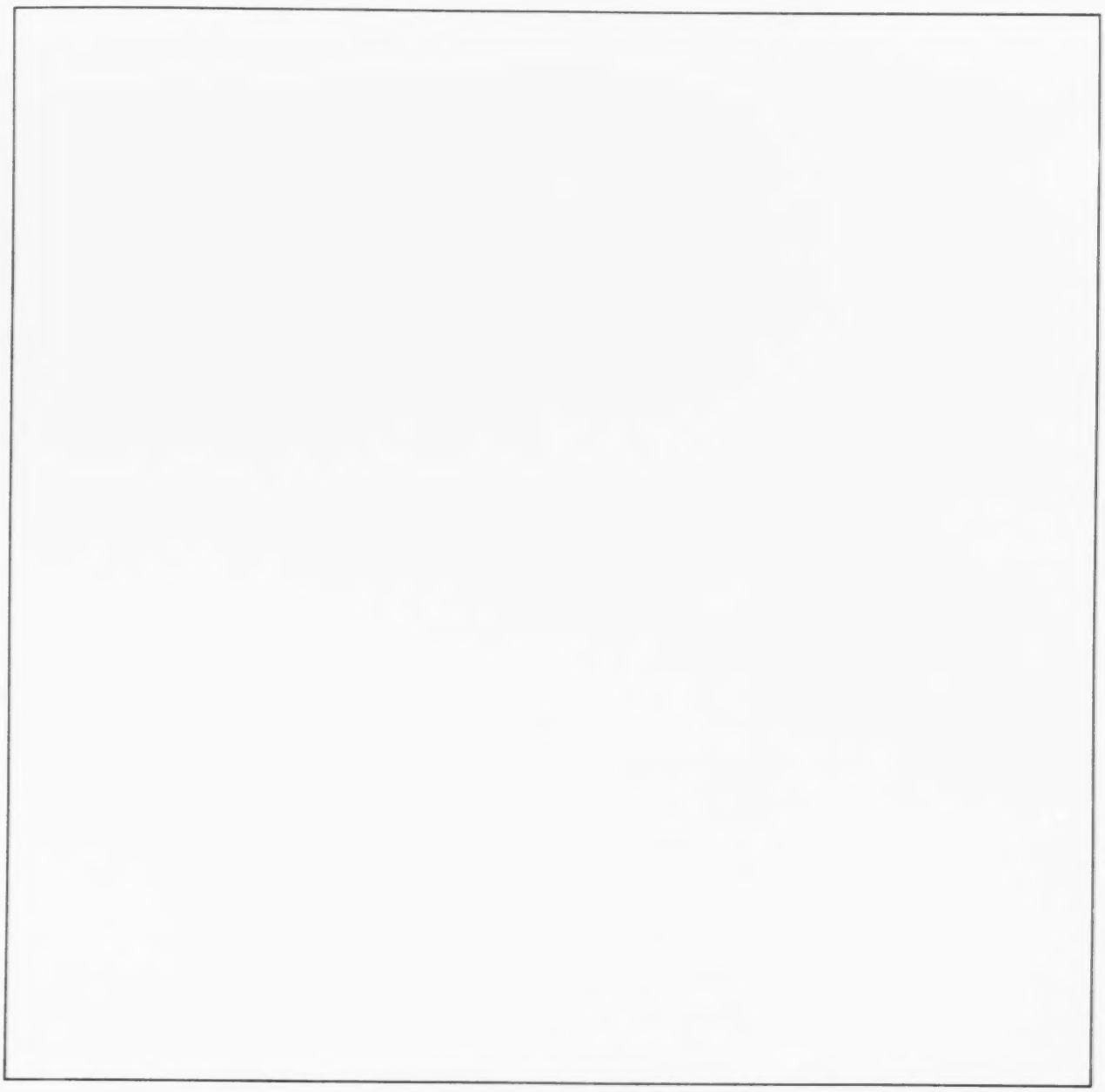
What do plant stems grow toward?

_____

Plant Watch

Do this page after you've finished Experiment 2.

Get the seedlings you used in that experiment. Draw the cup and the seedlings. Show how the seedlings grew toward light.



Check Yourself

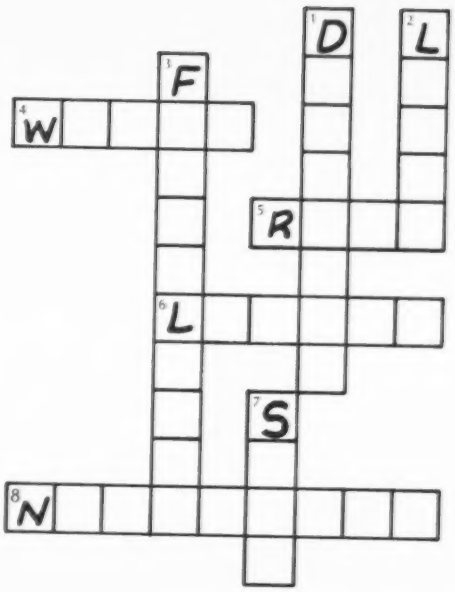
Use words from this unit to do the crossword puzzle. The clues below will help you. In the puzzle, each word is started for you.

Across

4. This helps a plant keep its shape.
5. This part of the plant takes in water.
6. These parts of a plant face the sun.
8. Plants need these to stay healthy.

Down

1. Minerals in the soil do this in water.
2. This is what plant stems grow toward.
3. This is sometimes given to plants that look sickly.
7. The tip of this part of the plant moves.



Check These Out

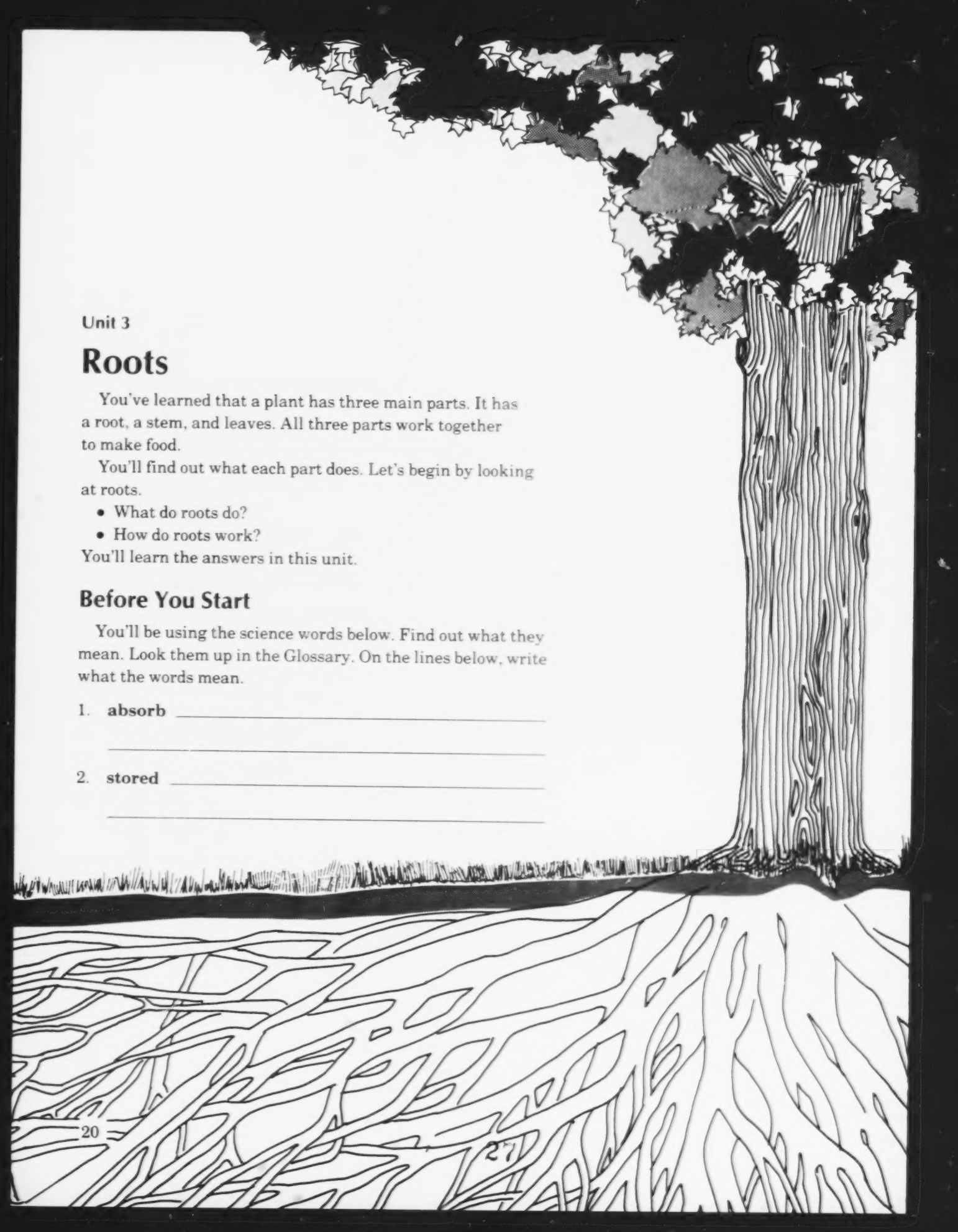
1. Find out about fertilizers. Visit a plant store or plant nursery. Ask these questions: What's in fertilizers? Why are there different kinds of fertilizers?

2. What is compost? Find out. Ask someone who grows plants. Or look in books on how to grow plants.

3. Choose a plant to learn about. It can be any kind of plant. Find out these things:
   - How often should you water it?
   - How much light does it need?
   - When should it be fertilized?

   Tell the class what you learned.

4. Here are more things you may want to find out:
   - What is plant classification? How do scientists classify plants?
   - Who was Gregor Mendel and what did he discover about plants? What are genes? What are chromosomes?
   - What is a Venus Flytrap? What other plants are like it?



Unit 3

Roots

You've learned that a plant has three main parts. It has a root, a stem, and leaves. All three parts work together to make food.

You'll find out what each part does. Let's begin by looking at roots.

- What do roots do?
- How do roots work?

You'll learn the answers in this unit.

Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **absorb** _____

_____

2. **stored** _____

_____

The Hidden Part

When you look at a tree, what do you see?

_____

_____

_____

You probably see a big, brown trunk. You probably also see lots of green leaves. But there's a part of the tree that you don't see—its roots.

Did you know that a tree is really a large green plant? It is like the plants you grew from seeds.

The roots of a tree are like the roots of your plants. All roots do these three things:

1. Roots hold the plant in the ground. They keep the plant from falling over.
2. Roots store food. A plant often makes more food than it needs right away. That extra food goes into the plant's roots.
3. Roots get water and minerals for the plant.

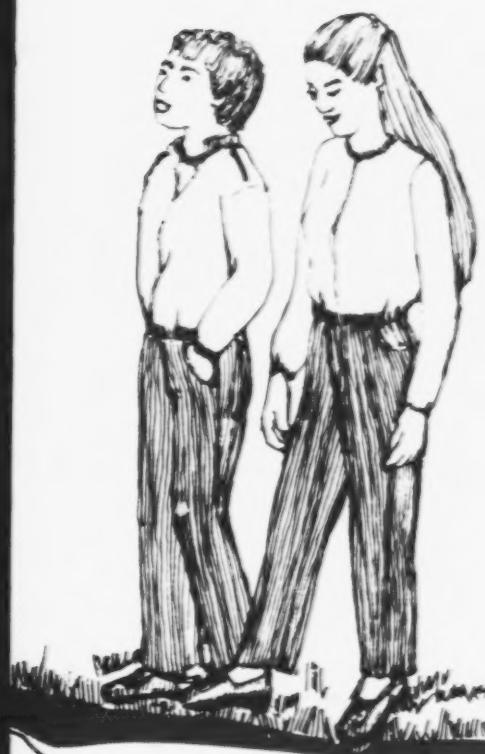
Roots are always growing. As a plant gets bigger, its roots spread out farther and farther under the ground. They also go deeper and deeper into the ground.

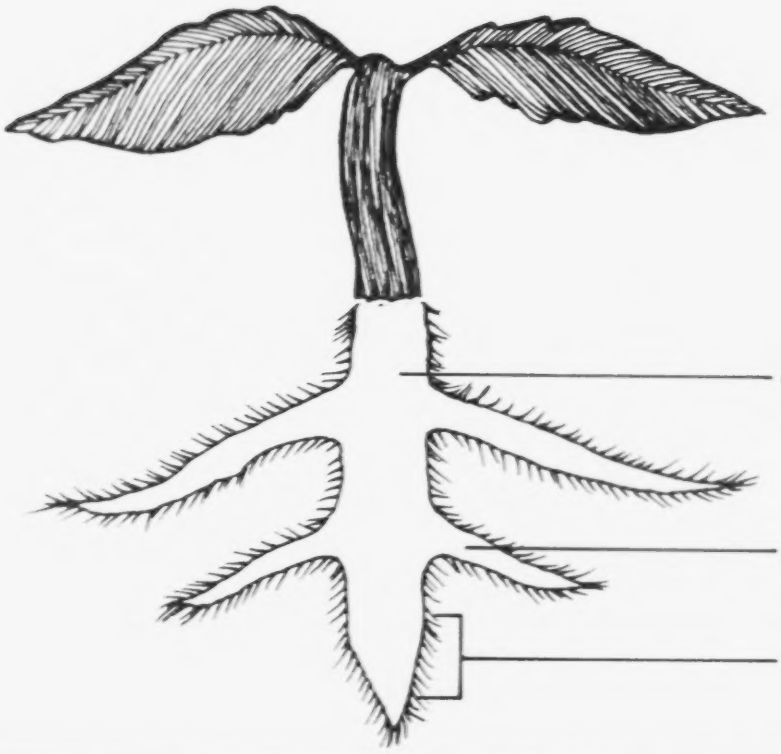
What do you think would happen to a plant if its roots stopped growing?

_____

_____

_____





This is the _____ .

This is a _____ .

These are _____ .

The roots of a seedling

Water Finders

You know that roots get water for a plant. As the plant grows bigger, it needs more and more water. So the roots grow longer, and new roots start to grow.

Think back to when you planted your radish seeds. What was the first thing that came out of each seed?

_____

The first thing was a root. That root was the **main root** of the plant.

As the plant grew bigger, the main root grew longer. It grew down into the soil.

Right after the main root grew, smaller roots started to grow. They grew out of the main root. Those smaller roots were **secondary roots.**

Secondary roots grow in all directions. They get water for the plant.

How does water get into the plant? Here's how: The main root and the secondary roots are covered with tiny **root hairs.** Those root hairs absorb water from the soil. The water moves from the root hairs to the secondary roots. It moves through the secondary roots to the main root. Then the main root takes the water to the stem of the plant.

Look at the picture above. It shows the roots of a seedling. Write *root hairs* next to the parts that absorb water. Write *secondary root* next to a part that carries water to the main root. Write *main root* next to the part that takes water to the stem.

Get into a Root

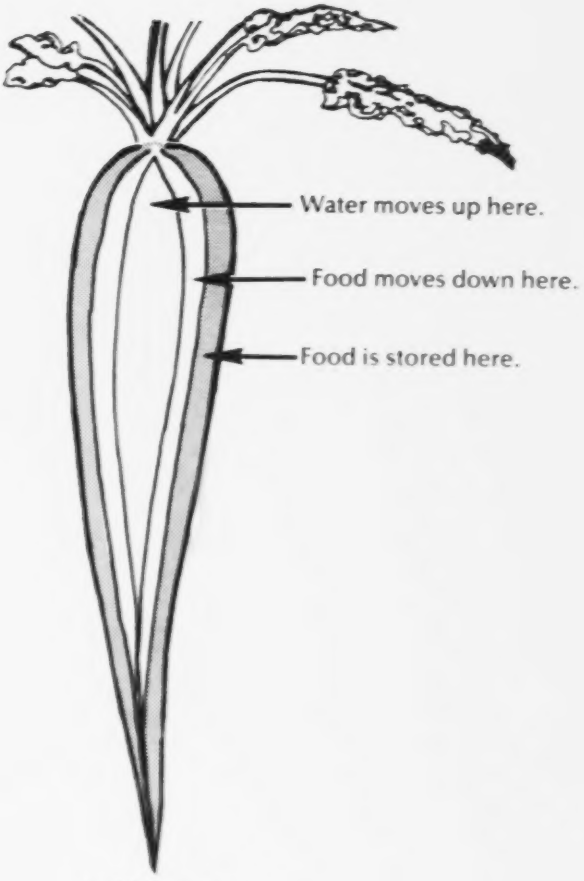
Did you know that a carrot is a root? It is. And like all roots, it stores food and gets water.

There are three parts inside a carrot. Water moves up one part. Food moves down another. And food is stored in the third part.

Look at the picture below. It shows the three parts.

Now get a carrot. Cut off the top. Then cut the carrot the long way. Look for the three parts.

Draw your carrot on this page. Show its three parts. Then color each part of the carrot a different color.



Inside a root

Plant Watch

Choose a bean plant you've grown. It should have at least four leaves.

Carefully take the plant out of its cup. Brush off any soil that sticks to the roots. Straighten out the plant on a piece of paper.

Now look for these parts:

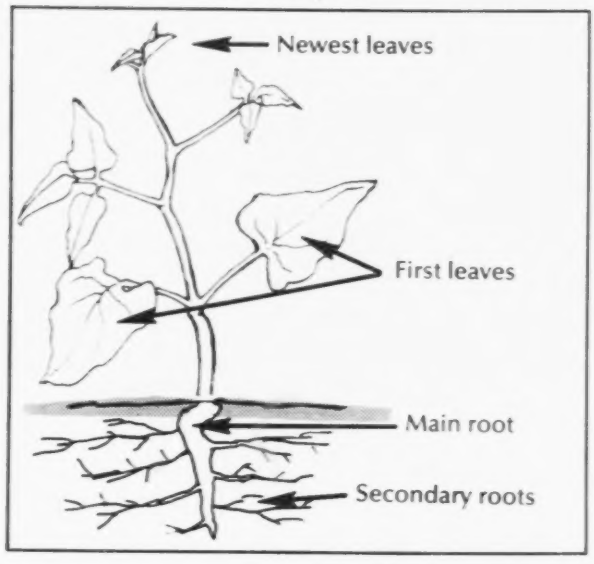
1. Find the first leaves the plant grew. (Hint: Look toward the bottom of the stem.)
2. Find the newest leaves—the ones the plant just grew. (Hint: Look at the tip of the stem.)
3. Find the main root. (Hint: It's the long root in the middle.)
4. Find some secondary roots. (Hint: They grow out of the main root.)

Now draw your bean plant. Be sure to show these parts:

First leaves	Main root
Newest leaves	Secondary roots

On your drawing, write the name of each part. Your drawing should look something like the picture below.

A bean plant



Check Yourself

1. What three things do roots do? Put an **X** in front of each of the three things.

   _____ a. Hold the plant in the ground

   _____ b. Make food

   _____ c. Store food

   _____ d. Get water and minerals

   _____ e. Get light

2. Show what you know about roots. Use the words below to finish the sentences. One word will be left over.

   absorb soil secondary roots
   main root stem

   The root hairs _____ water. Then water goes into the _____ _____. Next the water goes up the _____ _____ and into the _____.

Check These Out

1. Go to the vegetable section of a grocery store. Find roots you can eat. Some examples are carrots, radishes, and beets. Make a list of the roots you find.

2. Make a carrot cake. Find a recipe in a cookbook, or ask your teacher for a recipe.

3. To watch roots grow, do this: Make a hole in the bottom of a plastic glass. Fill the glass with small colored rocks.

   Get two or three seeds that have just sprouted. Put these seeds inside the glass, next to the sides. Once a day, pour a mixture of water and liquid fertilizer into the glass.

   As the plants grow, you'll see the roots fill up the glass.

4. Here are some things you may want to find out:
   - What is a tropism? Why do roots grow down?
   - What is osmosis? What does it have to do with roots?

Unit 4

Stems

A bunch of celery, a tree **trunk**, and a potato: How are these alike? Believe it or not, they are all stems.

A bunch of celery, a tree trunk, and a potato don't look alike at all. But they all do the same things. They all do what stems do.

- What do stems do?
- How do stems work?

You'll find out in this unit.

Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **pipe** _____

_____

2. **stalk** _____

_____

Up and Down the Pipes

You know that plant roots get water. That water goes to the plant stem. Where do you think the water goes from there?

_____

The water goes up the stem and into the leaves. How does it do that?

Think of how water gets into your house. Your house has pipes. Water moves through those pipes. A plant stem also has pipes. The pipes go all the way from the roots to the leaves. Some of those pipes carry water. Some of those pipes carry food.

Look at the picture at the right. It shows how water and food move up and down a stem.

What moves *up* the stem?

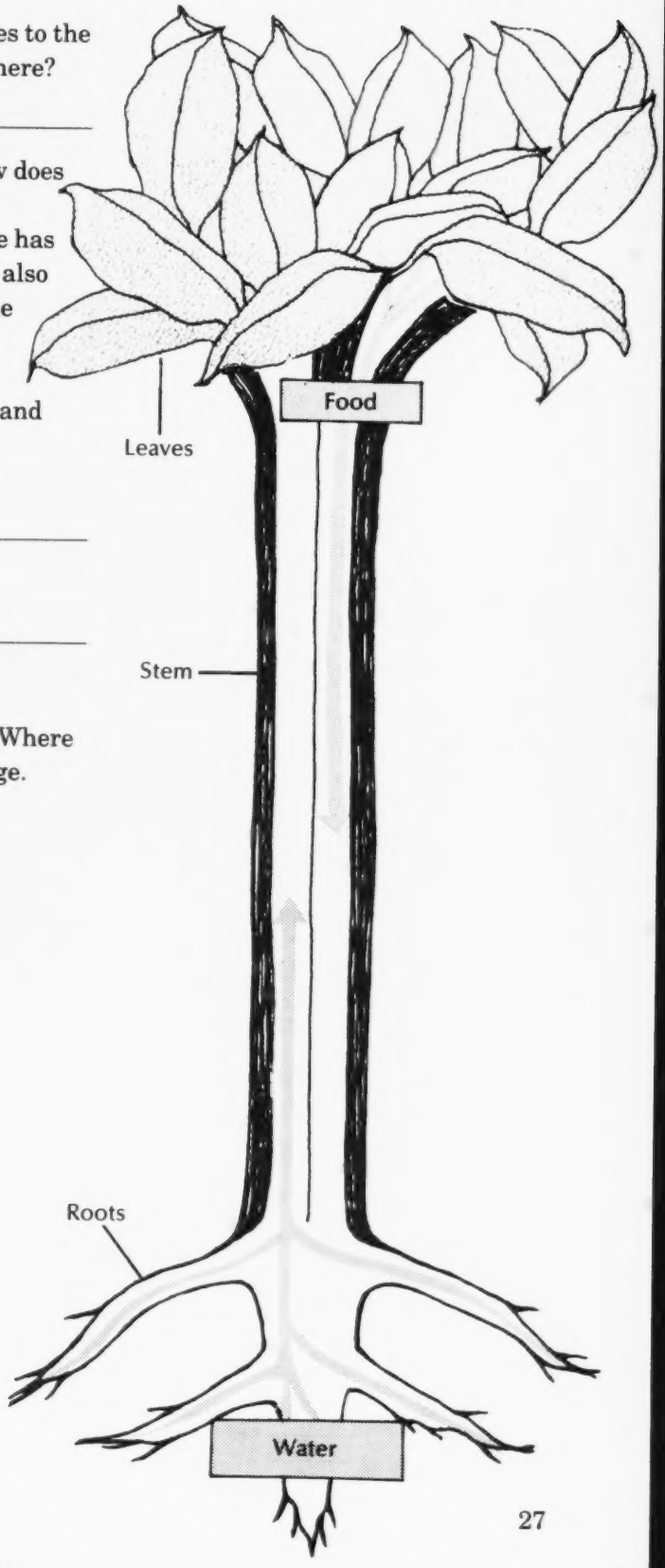
_____

What moves *down* the stem?

_____

Water moves up. Food moves down.

A celery stalk is a stem. Like all stems, it has pipes. Where are the pipes in a celery stalk? Find out on the next page.



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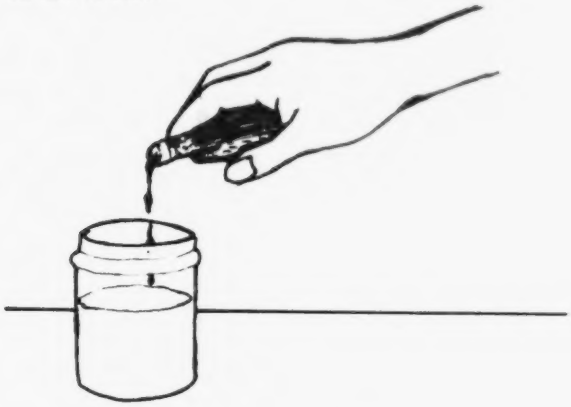
Inside a Stem

You can see how water moves up a plant stem. You can also see some of the pipes. You will need:

- A celery stalk
- Food coloring
- A jar of water

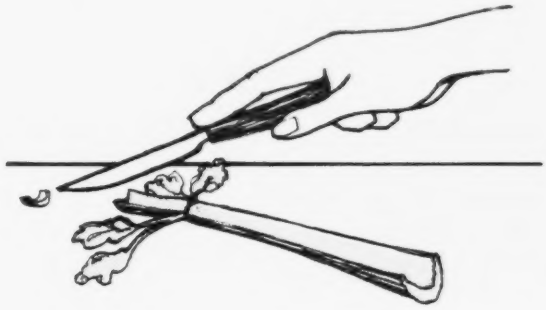
1

Dissolve some food coloring in the water.



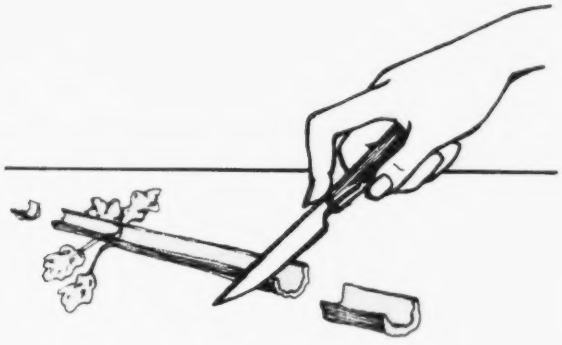
2

Get the celery stalk. Cut a thin slice off the top. Don't cut off any leaves.



3

Cut off the bottom of the stalk.



4

Put the celery stalk into the colored water. Then put the jar in a place that gets light. Wait one day. What do you think will happen?

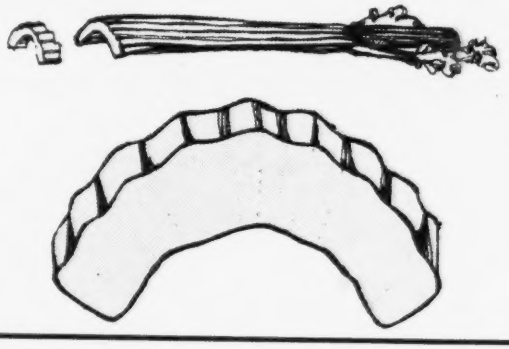
_____

_____

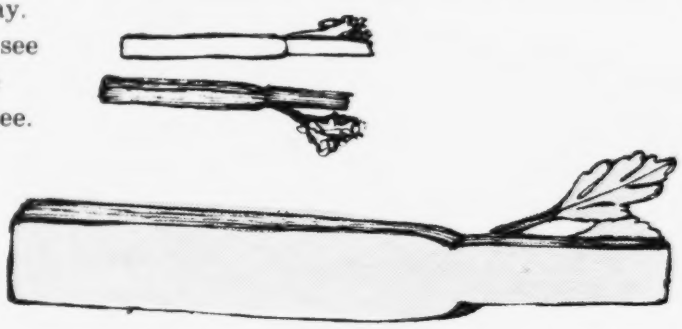
What Happened?

After one day, take the celery stalk out of the water. Then follow these directions.

1. Cut a one-inch slice off the bottom of the stalk. Look at the cut end of the stalk. Do you see colored dots? Each dot is the middle of a pipe. On the picture at the right, draw the dots you see.



2. Cut the stalk into two pieces the long way. Look at the cut side of one piece. Do you see colored lines? Each line is a pipe. On the picture at the right, draw the lines you see.

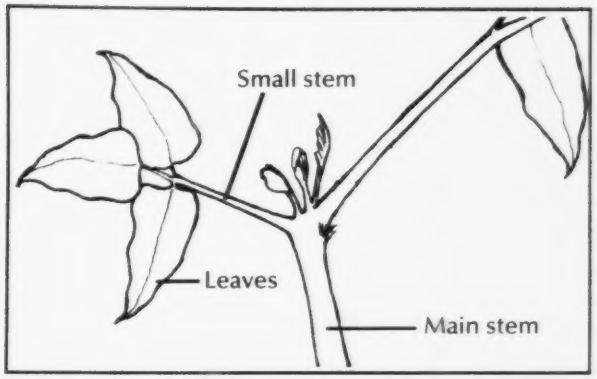


3. Find a leaf that has lots of color. How did the color get to the leaf?

_____

_____

Where is the color on the leaf? On the picture at the right, show where the color is.



Part of a bean stem

Plant Watch

Get the biggest bean plant you have. It should have one long stem and a few short stems.

Do you see the long stem? It's the main stem. It grows straight up from the soil.

Do you see small stems growing from the main stem? Count those small stems. How many are there?

_____

Do you see leaves growing from small stems? Count those leaves. How many are there?

_____

Do you see anything else on the stem? Write what you see.

_____

Now draw your bean plant. Be sure to show these parts:

Main stem
Small stem
Leaves
Anything else

On your drawing, write the name of each part. Your drawing should look something like the picture above.

Bean plant

Check Yourself

Use words from this unit to finish the sentences below. The first letter of each missing word is given. (If you need help with spelling, look in the Glossary.)

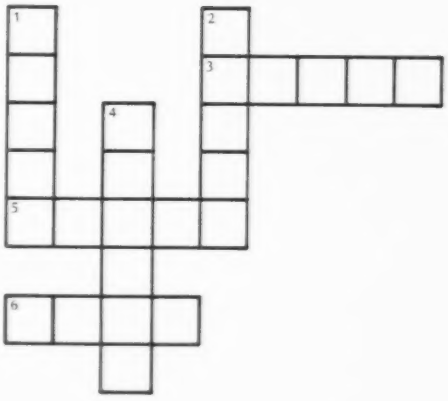
Then use the words you wrote to do the crossword puzzle.

Across

3. Plant r_____ get water.
5. One long piece of celery is a s_____ .
6. The main s_____ of a plant grows straight up from the soil.

Down

1. Water moves through p_____ in a plant stem.
2. A tree t_____ is a large stem.
4. Pipes in a stem go from the roots to the l_____ .



Check These Out

1. Change the color of a flower. Get a white flower. Cut the stem six inches below the flower. Put the stem in colored water for a day or two. If you want to, put the stem in different-colored water on the second day. Watch what happens.
2. Look around your house. Find as many things as you can that are made from tree trunks. (A magazine and a wooden table are two examples.) Make a list of what you find.
3. Here are some things you may want to find out:
   - Usually, gravity pulls water down. But water moves up in a stem. Why does it move up?
   - What does the inside of a stem look like under a microscope?
   - What is xylem? What is phloem? What do they do in a stem?

Unit 5

Leaves

Did you have an apple at lunch today? Or eat some corn chips? Did you have onions in your sandwich? If you did, you ate parts of green plants.

Apples, corn, and onions all contain food that a green plant made. The leaves of the green plant made that food.

- What do leaves use to make food?
- How do leaves make food?
- Why are leaves green?

You'll learn the answers in this unit.

Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **energy** _____

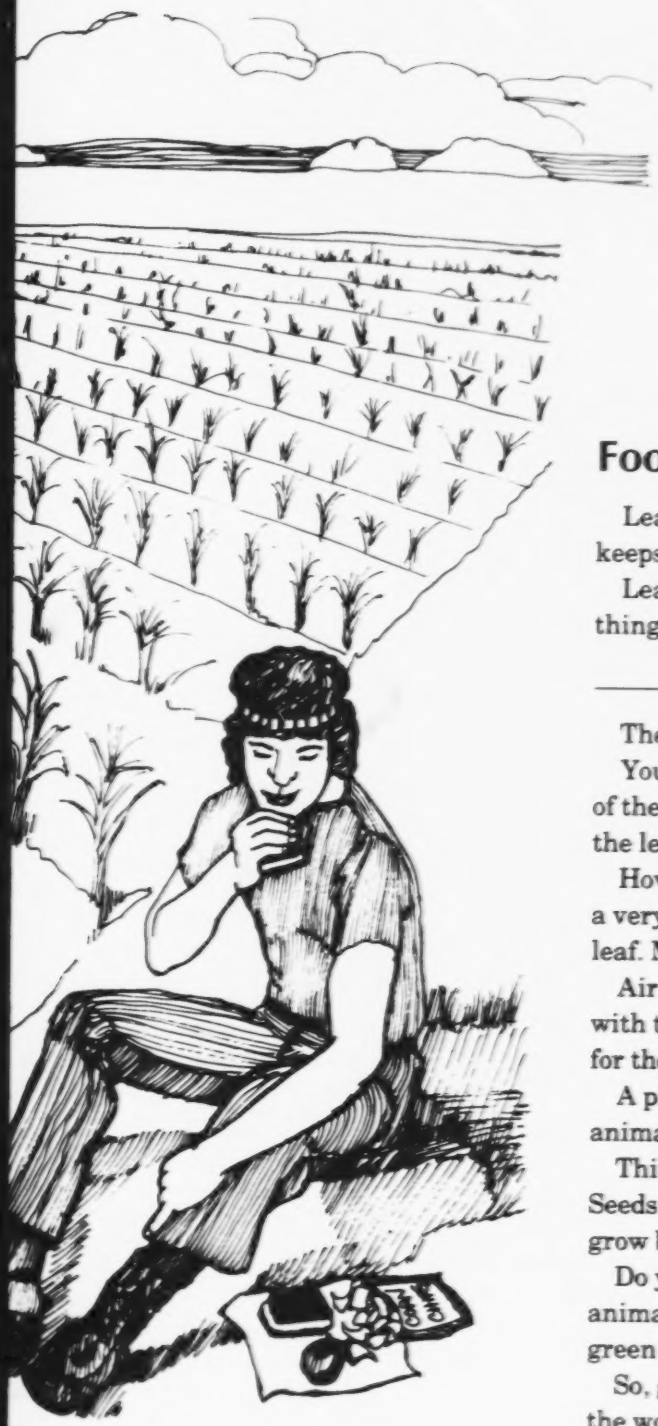
_____

2. **gases** _____

_____

3. **water vapor** _____

_____



Food Makers

Leaves make the food that a green plant needs. That food keeps the plant alive and growing.

Leaves make food out of two very simple things. One of those things is air. What do you think the other thing is?

_____

The other thing is water.

You learned how a leaf gets water. Water goes into the roots of the plant. From the roots, it moves up the stem and into the leaves.

How does a leaf get air? Suppose you looked at a leaf through a very powerful microscope. You'd see tiny holes all over the leaf. Most of the holes are on the underside of the leaf.

Air goes into the leaf through those holes. The air mixes with the water in the leaf. Then the leaf is ready to make food for the plant.

A plant uses the food that its leaves make. People and other animals use that food too.

Think of the food you eat. Do you eat fruits and vegetables? Seeds and grains? Those are all parts of green plants. They grow because of the food that leaves make.

Do you eat beef? Pork? Chicken? Those foods come from animals. Those animals grow because they eat the food that green leaves make.

So, green plants give us the food we eat. What do you think the world would be like if we didn't have green plants?

_____

_____

_____

In and Out

To make food, green leaves take in two things—water and air. But they also give out two things. Those two things come out of the tiny holes in the leaves.

Air is made up of different gases. One of those gases is **carbon dioxide**. When leaves take in air, they use carbon dioxide to make food. As they make food, they change carbon dioxide into another gas. That gas is **oxygen**. Oxygen goes out of the leaves and into the air.

So, one of the things that leaves give out is oxygen. People and other animals need oxygen. Without it, they couldn't live.

Look at the picture on this page. Finish the sentences above the picture. Use the words *oxygen* and *carbon dioxide*.

Leaves take in _____.

Leaves give out _____.

Experiment 3
What else do leaves give out?

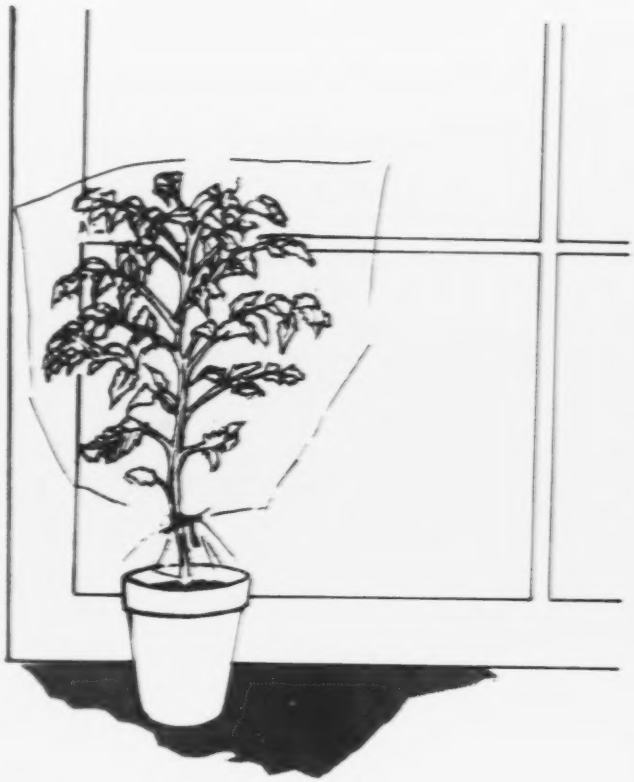
Materials

A tomato plant that has lots of leaves

A plastic bag big enough to fit over the plant

A piece of string or a plastic-bag tie

A sunny window



Procedure

1. Water the plant. Then put the plastic bag over the plant. Make sure all the leaves are covered.
2. Tie the bag around the stem.
3. Put the plant next to a sunny window. Leave it there for a day.

Observations

After a day, what do you see on the inside of the plastic bag?

_____

Where do you think it came from?

_____

Conclusion

Leaves give out oxygen. What else do they give out?

_____

What Goes Up Must Come Out

When you did Experiment 3, you found out that plant leaves give out water. Where does the plant get that water from?

_____

The plant gets that water from the soil. Suppose you water a plant. Water goes into the soil. The roots absorb water. The water moves up the stem and into the leaves.

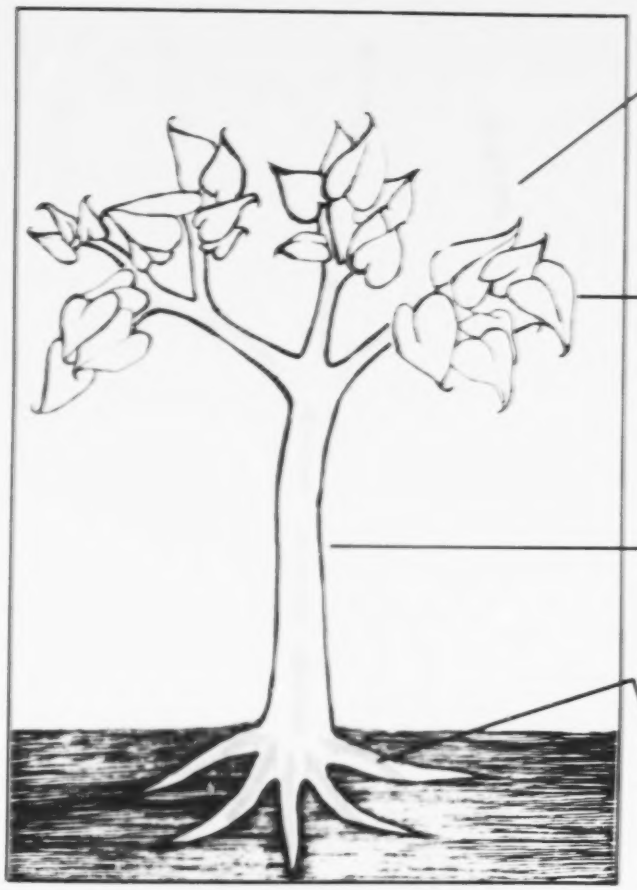
The leaves use some of the water to make food. What do you think happens to the rest of the water?

_____

The rest of the water goes out of the leaves.

You usually can't see the water that comes out of leaves. That's because the water is in the form of water vapor. Water vapor is a gas. (In Experiment 3, you saw the water because of the plastic bag. The bag trapped the water vapor. And the vapor turned back into water.)

Look at the picture of a plant on this page. It shows how water moves through a plant and out of the leaves. There are four steps. Write sentences that tell about each step. Start with 1 at the bottom of the page.



How water moves through a plant

4. _____
_____
_____

3. _____
_____
_____

2. _____
_____
_____

1. _____
_____
_____

The Facts of Light

Think of how you make a cake. You mix together some dry things and some wet things. You put the mixture into a hot oven. The heat energy in the oven turns the mixture into a cake.

Now think of how leaves make food. Leaves mix water with air. But they can't turn the water and air into food without energy. Where do you think leaves get energy?

Leaves get energy from light. That light usually comes from the sun.

There's a special name for the way green leaves make food. That name is **photosynthesis**. *Photo* means "in light." (A *photo*graph is a picture taken in light.) *Synthesis* means "making something." What do you think *photosynthesis* means?

Photosynthesis happens in green plants because of something that's in their leaves. That something is **chlorophyll**. (Many plants have chlorophyll in their stems too.) Chlorophyll traps light energy. Then leaves use that light energy to turn water and air into food.

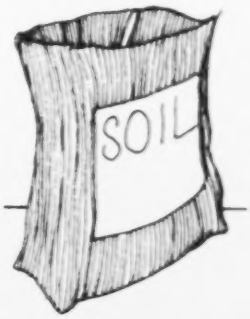
A plant that doesn't get any light looks different from a plant that gets light. That's because light does something to chlorophyll.

What does light do? You'll find out in the next experiment.

Experiment 4
What does light do to chlorophyll?

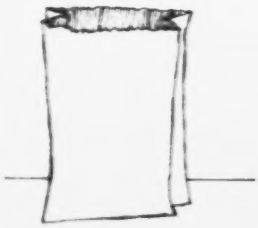
Materials

4 lima beans



Soil

Styrofoam cup

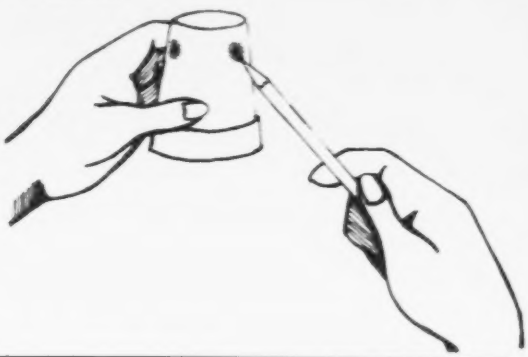


Paper bag

Procedure

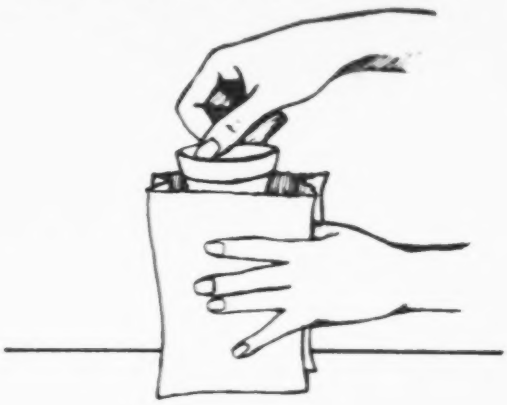
1. Soak the beans overnight.

2. Turn the cup over. With a pencil, poke three holes near the bottom of the cup.

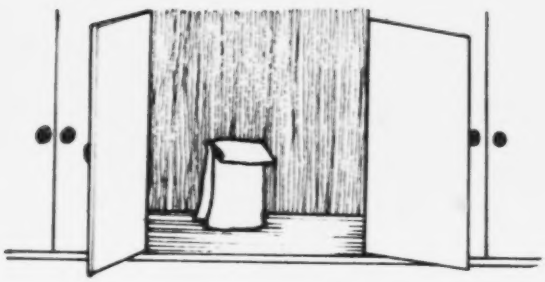


3. Fill the cup with soil. Put the soaked seeds on the soil. Cover the seeds with a thin layer of soil. Water the soil.

4. Put the cup into the paper bag. Make sure the cup stands up in the bag.



5. Close the bag so that no light can get into it. Put the bag in a place away from light, such as a cupboard. Leave the bag there until the seeds sprout and grow leaves (about four or five days).



6. When the seedlings have leaves, take the cup out of the bag. Put the cup in a sunny window. (Or put it under strong fluorescent light.) Leave the seedlings there for at least an hour.

Observations

1. What color were the seedlings when you took them out of the bag?

_____

2. What color are the seedlings after they get light?

_____

Conclusion

What does light do to chlorophyll?

_____

_____

Plant Watch

Choose a plant you've grown. It should have lots of leaves. Notice that the leaves are spread out. And most of the leaves face one way. They face the light. That way, each leaf gets as much light as it can.

Turn the plant so that the leaves are facing you. Then, in the space below, draw what you see. Your drawing should look something like the picture at the right.

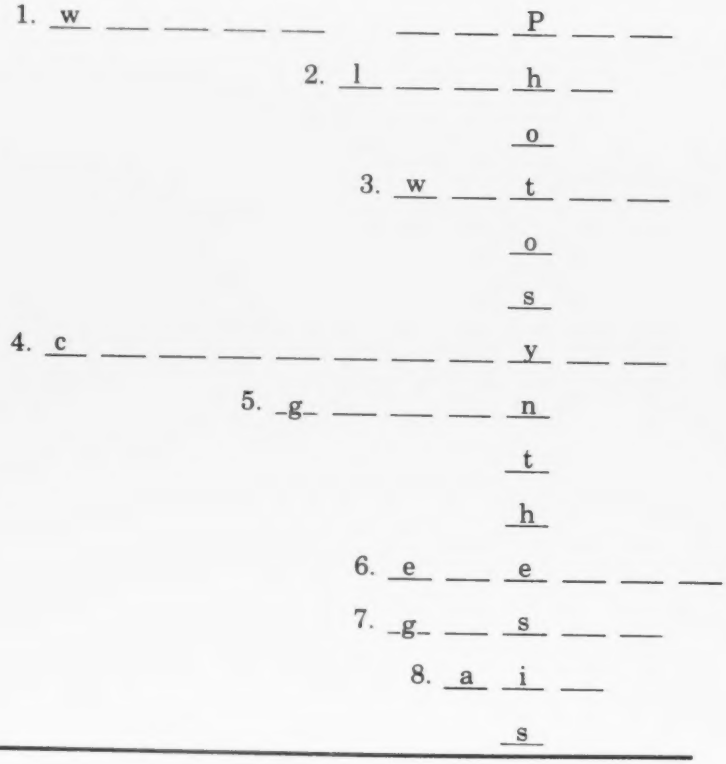
Leaves spread out and face the light.

Check Yourself

How much do you know about photosynthesis? Use words from this unit to do the puzzle. The hints below will help you.

Two letters from each word are given. If you need help with spelling, look in the Glossary.

1. What green leaves give off
2. Photosynthesis can't happen without this
3. This moves from the roots to the leaves
4. What traps the energy in light
5. The color chlorophyll turns
6. Green leaves get this from light
7. What oxygen and carbon dioxide are
8. What goes into a leaf through tiny holes



Check These Out

1. Make a leaf rubbing. Cover a leaf with a very thin piece of paper. Lightly color the part of the paper that's over the leaf. Use crayon, chalk, or pencil. You'll get a picture of the leaf. On it, write the name of the plant the leaf came from.
2. Make pressed leaves. Get some leaves. Put each leaf inside a folded paper towel. Then put the towels inside a thick book. Keep them there for a few days. When the leaves are flat and dry, tape them to heavy paper. Under each leaf, write the name of the plant it came from.
3. Here are some things you may want to find out:
   - Why do leaves change color in the fall?
   - Some plants, such as mushrooms, don't have chlorophyll. How do those plants get food?
   - Plants need carbon dioxide. People need oxygen. How do they get those things from each other?
   - How do plants reproduce?

Unit 6

New Plants from Old Plants

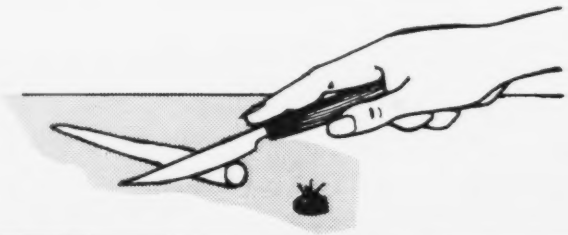
Start Plants from Roots

You have started plants from seeds. There's another way to start plants. You can start new plants from parts of old plants.

You can start some kinds of plants from roots. Do this: Get a carrot. If the carrot has stems and leaves, cut them off. Then follow these directions.

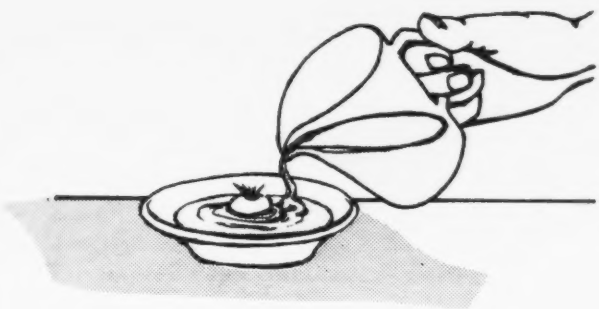
1

Cut a one-inch piece off the top of the carrot.



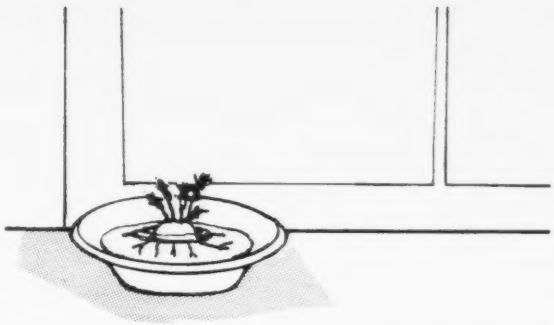
2

Put the carrot top into a dish. Cover most of the carrot top with water.



3

Put the dish in a place that has light. Leave it there. If the water starts to dry up, add more water. In a few days, roots and leaves will grow out of the carrot top.



What other plants can you start from roots? Find out. Put the tops of roots from three different plants in water. Write the names of the plants below. Then write what happens.

Name of Plant	Did it Grow?

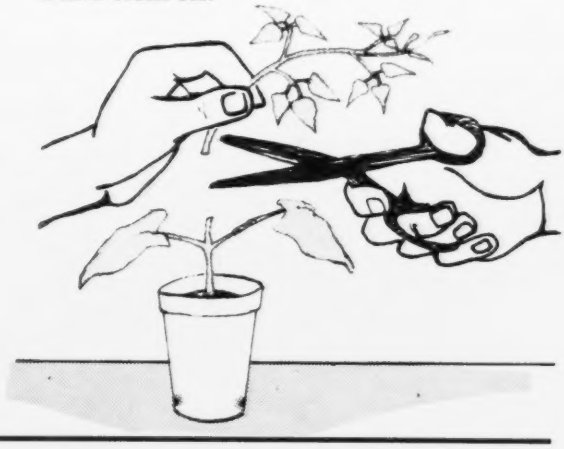
Start Plants from Stems

You can start some kinds of plants from stems. Here's one way: Cut off a stem from a plant. The stem should have some leaves on it. Put the stem in a glass of water. In a few days, roots will grow out of the stem.

Here's another way to start a plant from a stem.

1

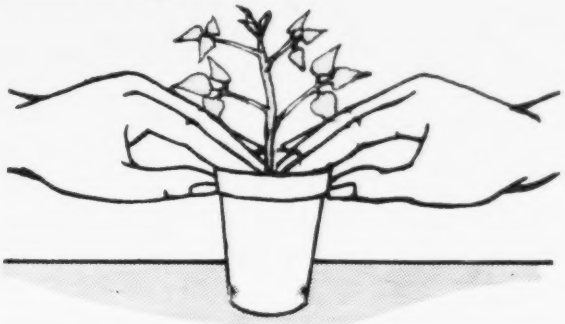
Get a bean plant that you grew. Cut a stem off.



2

Poke holes near the bottom of a paper cup and fill the cup with soil. Wet the soil.

With a pencil, make a hole in the wet soil. Put the stem into the hole. Carefully pack the soil around the stem so the stem stands straight up.



3

Put the cup in light. Water the soil when it gets dry. In a few days, roots will grow out of the stem under the soil.

What other plants can you start from stems? Put stems from three different plants in water. Write the names of the plants below. Then write what happens.

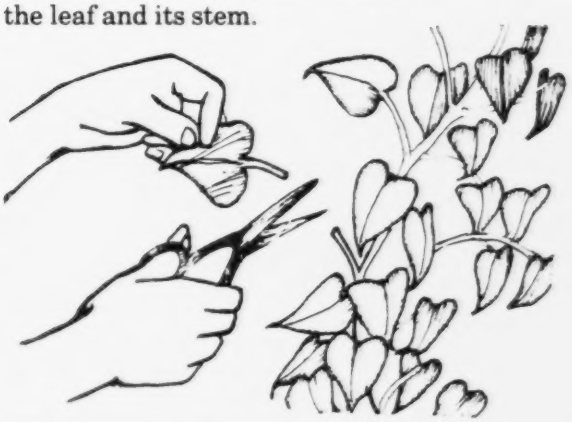
Name of Plant	Did it Grow?

Start Plants from Leaves

You can start some kinds of plants from leaves. Try it with one of these plants: jade, ivy, or philodendron.

1

Choose a healthy leaf. Cut off the leaf and its stem.

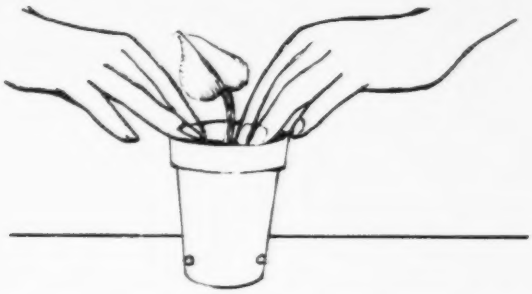


2

Poke holes near the bottom of a paper cup and fill the cup with soil. Wet the soil.

3

Put the leaf stem into the wet soil. Carefully pack the soil around the stem so the leaf stands straight up.



4

Put the cup in light. Water the soil when it gets dry. In a few days, roots will grow out of the stem under the soil.

What other plants can you start from leaves? Put leaves from three different plants into soil. Write the names of the plants below. Then write what happens.

Name of Plant	Did it Grow?
_____	_____
_____	_____
_____	_____

Plant Watch

Choose a plant that you started from a plant part. It can be a plant grown from a root, a stem, or a leaf.

Draw that plant on this page. In your drawing, be sure to show the plant part that it grew from.

Under your drawing, write the name of the plant. Then write which plant part it grew from.

A _____ grown from a _____
(name of plant) (plant part)

Show What You Learned

What's the Answer?

Put an **X** in front of the right word or words. There may be more than one correct answer to a question.

1. What does a seed need to sprout?
   - _____ a. Water
   - _____ b. Warmth
   - _____ c. Chlorophyll
2. What are the three main parts of a plant?
   - _____ a. Leaves, root, and stem
   - _____ b. Root, seeds, and leaves
   - _____ c. Leaves, stalk, and stem
3. What do roots do?
   - _____ a. Hold a plant in the ground
   - _____ b. Make food
   - _____ c. Get water
4. How does water move up and down a stem?
   - _____ a. Through nutrients
   - _____ b. Through root hairs
   - _____ c. Through pipes
5. What do leaves use to make food?
   - _____ a. Seeds, oxygen, and other gases
   - _____ b. Water, carbon dioxide, chlorophyll, and light energy
   - _____ c. Soil, darkness, chlorophyll, and a cup

What's the Word?

Write the correct word for each meaning.

1. A very young plant

   S _____
2. Break down into very small pieces in water

   D _____
3. Something plants need to stay healthy

   N _____
4. Soak up water

   A _____
5. A stem on a celery plant

   S _____
6. The way that green plants make food

   P _____
7. The power that makes things change

   E _____

Congratulations!

You've learned a lot about green plants.

You've learned:

- How to start plants from seeds or other plants
- What plants need to grow
- How plants make food
- Many other important facts about plants

Glossary

ab sorb: soak up water

car bon di ox ide: a gas that leaves make food with

chlo ro phyll: something in a green leaf that traps light energy

dis solve: break down into very small pieces in water

en er gy: the power that makes things change

fer til iz er: a mixture of things plants need to stay healthy

flu o res cent: a kind of electric light, usually shaped like a tube

gas es: what air is made up of

leaves: the parts of a plant that make food

light: one thing plant leaves need to make food

main root: the first root that grows out of a seed

nu tri ent: something plants need to stay healthy

ox y gen: a gas that leaves give out

pho to syn the sis: the way that green plants make food

pipe: something that water moves through

root: the underground part of a plant

root hairs: tiny root parts that soak up water

sec ond ar y roots: roots that get water

seed ling: a very young plant

soil: the earth that plants grow in

sprout: start to grow

stalk: a stem on a celery plant

stem: the part of a plant that connects the root and the leaves

stored: kept to be used later

trans plant: dig up and plant again

trunk: the main stem of a tree

wa ter: one thing that plants need to grow

wa ter va por: water in the form of a gas

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